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ANNUAL REPORT

OF THE

FOREST INSECT CONDITIONS

IN

OREGON AND WASHINGTON

FOR

1933

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1933.

Prepared By The
Bureau of Entomology

In Cooperation With The:-
Forest Service,
Park Service,
Indian Service,
State and Private
Timber Agencies.

Portland, Oregon.
May 1, 1934.

T. M. FILE COPY

UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY

Portland, Oregon,
May 1, 1934.

To Officers In Charge Of
Forest Protection Agencies:

This report has been prepared in order to give forest officers a complete picture of present forest insect conditions in Oregon and Washington as determined by surveys conducted during the calendar year 1933, on all classes of forest land. In addition to information as to the present status of insect outbreaks, the report includes summarized data on plot surveys made during the year, data on the control campaigns conducted and general estimates of forest damage caused by activities of the western pine beetle. Please bring the report to the attention of the field men responsible for forest protection work in your organization.

For detailed information on the habits, life histories and control of the forest insects mentioned in this report, you are referred to the Forest Insect Handbook issued by the Regional Forester's Office, Portland, Oregon in April 1933.

The data presented in this report were secured through the cooperative effort of the Forest Service, Park Service, Indian Service, State and private protection agencies with the Bureau of Entomology. In particular, acknowledgement is made of the help of Forest Rangers who have assisted us in the plot surveys; Mr. A. J. Jaenicke who has reviewed and contributed to the section dealing with the situation on National Forests and to Mr. Harold Weaver who has supplied valuable material in respect to beetle control work on Indian Reservations.

It is planned to make one report of this character available to field men each year in order that they may keep informed of current progress in forest insect control activities. Any comments or suggestions you may have for the improvement of subsequent reports, in order that they may better serve this purpose, will be appreciated.

Very truly yours,

F. P. Keen

F. P. Keen,
Entomologist.

Forest Insect Field Station,
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FOREST INSECT CONDITIONS

IN

OREGON AND WASHINGTON

SURVEY OF 1933.

Each year, the forest protection agencies and the Forest Insect Field Station, of the Bureau of Entomology examine a large number of forest tracts to detect or control forest insect damage. The information obtained is recorded in separate detailed reports available only to a limited number of workers. To summarize the high lights of these reports and to give a more complete picture of forest insect conditions for the region as a whole, this generalized report has been prepared. It serves primarily as a reference report for those in need of information on the current insect situation and problems. This is the third annual report in a series started in 1930.

Sources of Information

The data compiled in this report has been obtained largely from forest insect surveys conducted by the Bureau of Entomology, the Forest Service, National Park Service, Indian Service, or by two or more of these agencies working co-operatively. On the National Forests, plot surveys were carried on by forest officers with the help of the entomologists as a part of the Administrative Study Program. Considerable more survey work was done this year as a part of the EC.? program, with the help of the CCC boys. On the Ochoco, a check survey was made of control project areas, with help employed with NIRA funds. The present report summarized the information gathered from all of these sources in order to give a broad picture of the forest insect conditions in the region during 1932-33.

RESUME OF PAST LOSSES

The destruction of ponderosa pine by the western pine beetle in southern Oregon has been the subject of investigation for many years, and there have been many reports covering the damage on specific areas for certain years. On the Southern Oregon-Northern California pine beetle control project area of over a million acres, a series of estimates starting with 1921 indicate the yearly damage and trend of the beetle epidemic conditions. But the losses on this area, while impressive in their magnitude, are in reality only a small part of the losses which have been sustained in the region as a whole. Only since 1929 have estimates been attempted as to the total timber losses resulting from in-

sect depredations in the region.

A recent estimate prepared for the Copeland Report indicates the average annual forest insect damage in the region as follows:

AVERAGE ANNUAL ABNORMAL FOREST DRAIN DUE TO INSECTS

IN THE PACIFIC NORTHWEST DURING THE DECADE 1921 - 1930

Insect	Timber Affected	Volume of Saw Timber Killed M. B. M.
OREGON		
Western pine beetle	Ponderosa pine	370,000
Mountain pine beetle	Lodgepole	21,000
Mountain pine beetle	White pine	14,000
Hemlock Looper	Hemlocks, etc	50,000
Other	Firs, etc	5,000
Total Annual Loss in Oregon		500,000
WASHINGTON		
Western pine beetle	Ponderosa pine	75,000
Mountain pine beetle	Lodgepole	1,000
Mountain pine beetle	White pine	17,000
Hemlock Looper	Hemlock, etc	18,000
Sitka Spruce aphis	Sitka spruce	12,000
Douglas Fir Tussock Moth	Douglas Fir	30,000
Other	Firs, etc	2,000
Total Annual Loss in Washington		155,000

THE FOREST INSECT DAMAGE OF 1932 - 33

Several factors combined to make 1932 the most disastrous year on record in respect to destruction of timber in the Pacific Northwest thru insect activity. First, drought conditions in the pine forest east of the mountains during 1929 and 1930 were still reflected in poor tree growth and low tree resistance. Then in April 1931, a windstorm of unusual severity blew down an immense amount of timber throughout the region. These down trees served as ideal breeding places for destructive barkbeetles which upon emerging attacked the green standing timber and started an epidemic which was not halted until the cold winter of 1932-33 suddenly destroyed a high percentage of the overwintering broods and materially assisted in bringing these epidemics under control. The most active insects are discussed below.

The Western Pine Beetle
(Dendroctonus brevicomis Lec)

As mentioned above, climatic and host resistance conditions made it possible for the western pine beetle to go on a rampage in the ponderosa pine stands of eastern Oregon and Washington and cause an appalling loss of timber in a single season. The destruction of from 1 to 2 percent of the stand in previous years, had been considered bad but in 1932 losses of 4%, 8% and 15% of the stand were not uncommon. In some forests, hundreds of trees were killed in single groups, all the timber on 10 acre tracts destroyed and as many as 1000 trees killed to a section. The destruction of ponderosa pine by the western pine beetle took on the character of mountain pine beetle epidemics in lodgepole or Black Hills beetle outbreaks in the Rocky Mountain pine stands.

The losses were heaviest in pine forests which had not in recent years suffered severely from beetle attack. The Ochoco and Malheur National Forests in Oregon and the pine stands of Klickitat County in Washington were the hardest hit, while in the old haunts of the beetles in Klamath County, Oregon, there was in many cases a surprising cessation of beetle activity, probably largely due to lack of sufficient susceptible host material to support another heavy beetle kill.

The progress of this tremendous beetle epidemic was suddenly interrupted by two periods of extremely low temperatures during December 1932 and February 1933 which resulted in the freezing of from 35 to 90 percent of the overwintering broods, depending upon the minimum temperatures which prevailed in different parts of the region. The destruction of broods was reflected in the low emergence of 1933 and a marked reduction in the 1933 losses. In general the 1933 losses were only one quarter to one third those of 1932 in Oregon, while in Washington where the effects of the winter freeze were not so noticeable the 1933 losses were nearly as heavy as those in 1932.

That this reduction in loss due to the winter freeze may be a temporary condition was indicated by the late fall surveys which showed that the beetles were building back in many areas and increasing their aggressiveness. Until the trees improve greatly in growth and vigor, the hazard of increased beetle activity is a real threat.

The Mountain Pine Beetle
(Dendroctonus monticolae Hopk)

Due to the control work conducted in Crater Lake National Park, the epidemic which has been in progress in that area for many years was brought under control in 1932. Adjacent National Forest areas were successfully treated. The only remaining lodgepole infestation in the National Forest which still threatens Park timber is the Sun Pass epidemic. This will be treated in the spring of 1934.

The freeze of 1932-33 also dealt a blow to the mountain pine beetle epidemics and only in heavy centers of aggressive infestation was activity continued during 1933. The Sun Pass area of the Rogue River National Forest in particular continued to show heavy beetle attack.

The Douglas Fir Beetle
(Dendroctonus pseudotsugae)

Two notable outbreaks of the Douglas fir beetle were examined during the year. On the Chelan National Forest an outbreak on the Toats Coulee District of the Sinlahekin game preserve was examined by Mr. Beal, who found that while the Douglas fir beetle appeared to be causing heavy damage in these stands, at the lower elevations at least the beetle work was secondary to drought conditions. At the higher elevations large groups of Douglas fir were dying where it was evident the Douglas fir beetle was the primary cause of death.

Under west side conditions, the Douglas fir beetle has never been thought of as a potentially destructive insect. But on a tract of land near Vernonia belonging to the Clark-Wilson Lumber Co., group killing of thrifty mature Douglas fir by this beetle was found to be occurring this year under conditions which indicate an aggressiveness of attack not previously credited to it. Groups of fifteen to twenty-five recently killed trees were found liberally scattered over an area of about 25,000 acres. No contributing causes were discovered and it appeared that the Douglas fir beetle alone was responsible for the death of these trees.

The Hemlock Looper
(Ellopia fiscellaria var. lugubrosa)

The hemlock looper outbreak in Pacific and Grays Harbor Counties which swept over 52,000 acres and killed some 165,000,000 feet of hemlock and other species during the period 1929, 1930 and 1931, was found to be very much on the decline in 1932 following the airplane dusting work carried on in July, 1931. Some extension of the damage was noted in Pacific County but no further killing of trees occurred in the Grays Harbor outbreak.

During 1933, due largely to the efficacy of parasites and wilt disease, it was difficult to find specimens in either area, and the outbreak can be said to be definitely at an end. As a further precaution,

specimens of Calosoma sycophanta, the large European caterpillar hunter were shipped from the gipsy moth laboratory and liberated in the area. It is hoped that this beneficial insect may become permanently established. Later shipments were made of the tachinid fly parasites Compsilura concinnata in an effort to also get this benefical insect established.

The Green Spruce Aphis
(Aphis abietina)

This insect which was so abundant in 1931 and evidently responsible for considerable damage to Sitka spruce was very scarce in 1932 and 1933.

The Pandora Moth
(Coloradia pandora)

During the spring of 1933 a new epidemic of the pandora moth was discovered on the Metolius area of the Deschutes National Forest. This is the first appearance of this moth since the notable outbreak of 1918-25 which seriously weakened the ponderosa pines over most of the Klamath Indian Reservation and neighboring forest. The abundance of caterpillars indicates that this may be just the beginning of another serious outbreak. Moths will fly in 1934 and heavy caterpillar feeding will not be noticed until 1935.

The Lodgepole Pine Needle Miner
(Recurvaria n. sp.)

A new species of needle-miner which attacks lodgepole in central Oregon was first found by Patterson in 1925, when an epidemic of this species spread through the lodgepole pine stands near La Pine, Oregon. After a few years this outbreak died out, but this year a new outbreak appeared and did noticeable damage to the foliage of lodgepole over a wide area of forest on the Deschutes National Forest and along the Dalles-California Highway near La Pine. It is expected that most trees will not be seriously injured by this defoliation and will quickly recover next year.

INSECT CONDITIONS ON PROTECTION UNITS

With the assistance of forest officers, park rangers and helpers under the ECW and NIRA programs, 32,300 acres of sample plots in the pine region were covered during the year with intensive cruises checking upon barkbeetle activity. This was in addition to the acreage covered with spotting work on the various control projects. The yearly cruising of sample plots has value from a number of standpoints. The work gives training to forest officers in recognizing barkbeetle damage and when control is needed. The plots serve as yardsticks with which to measure through comparison the losses on larger areas. The yearly loss data has definite value in judging the trend of barkbeetle epidemics, the factors involved and in making predictions as to probable forest yields. These cruising data on sample plots combined with general observations by the entomolo-

gists give a very fair picture of forest insect conditions throughout the region.

NATIONAL FORESTS OF REGION SIX

The insect surveys on National forests were confined to the ponderosa pine forests east of the Cascades. No reports were received of insect damage in the fir belt, except for species of minor importance.

Chelan National Forest

Loss of ponderosa pine timber from beetle activity has not been especially heavy on this forest except during the past five years when drought conditions have made the trees more susceptible to attack.

Early in November an insect examination of the forest was made by Mr. J. A. Beal of the Bureau of Entomology and the two sample plots were again cruised with the help of Rangers W. T. Burge and L. E. Griffiths.

These examinations showed that 1932 losses averaged about 2 percent but that the general condition of the pine timber stands was now moderately good. Losses in the Douglas fir have apparently been on the increase during the past few years and a general condition of many dead and dying fir extends over a large part of the forest. In parts of the Toats Coulee District of the Sinlahekin Game Preserve, serious losses are now occurring with the Douglas fir beetle the responsible agent. No control work is recommended.

Colville National Forest

Ponderosa pine stands are very patchy on the Colville N. F. and losses due to barkbeetles have not been particularly heavy in the past decade except during the last few years when drought conditions helped to increase the beetle damage.

One plot was cruised by Mr. J. A. Beal, Rangers J. B. Hogan and P. K. Taylor early in November and the recent losses determined. This plot showed a loss in 1932 of 3 percent of the pine. Following the cold winter of 1932-33 and the destruction of overwintering beetle broods, the losses for 1933 dropped to .8 percent.

Douglas fir defoliated by the Tussock moth, have been dying in large numbers during the past three years and over a large part of the forest the fir stands have been almost completely destroyed.

Deschutes National Forest

Heavy losses of ponderosa pine as a result of barkbeetle attack were sustained on portions of the Deschutes National Forest during 1931 and 1932. The most serious infestations were found on the Pot Holes, Panhandle, Orphan Butte, and Metolius areas, reaching a loss as high as 4.5 percent of the stand killed in one year on the Pot Holes section. These

losses were greatly reduced during 1933 as an aftermath of the winter killing of western pine beetle broods.

Beetle surveys were conducted on the Metolius area by Mr. Whiteside, of the Forest Insect Station, with the help of CCC helpers from the Sisters Camp. A large series of bark counts to determine the effectiveness of the winter kill were also made from this area. Losses on the check plots dropped from 1.2 percent of the stand in 1932 to .9 percent in 1933. No control work was undertaken.

The Panhandle-Orphan Butte project, which was first treated in 1931 was not recleaned in 1932 on account of the destruction of a high percentage of these broods by winter killing. A recruise of the area was made in the fall of 1933 with NIRA spotters under Forest Service supervision. This survey showed that there had been only a slight reduction of timber losses following the freeze and that control work was still needed. An allotment of $8,000 was made for this purpose and the control work was completed in January, 1934.

Other sample plots on the Forest were cruised by NIRA help and by Keen and Kolbe.

The total loss of timber from insects in the Bend unit on National Forest, Indian Reservation and private lands during the past three years is estimated as follows:-

1931 ------	150,000,000	board feet
1932 ------	200,000,000	" "
1933 ------	100,000,000	" "

Fremont National Forest

One 640 acre permanent sample plot on the Goodlowe unit, and nine other full section plots on private lands adjacent to the Fremont National Forest in the Bly District were cruised for insect losses during August and September by Mr. Buckhorn with a crew of CCC helpers from the private land camp at Bly (P-203). During the latter part of July, Mr. Jaenicke visited the forest and during the period October 16-19, Keen was assisted by Walt Perry and the District Rangers in cruising three plots in the Paisley and Silver Lake Districts.

In general these examinations showed that while the loss of ponderosa pine timber during 1932 as a result of western pine beetle activity had been very heavy, there had been a marked reduction in losses for 1933 due largely to the destruction of brood by cold weather and improved growth conditions. In only a few areas were losses of sufficient magnitude to warrant control.

In the Bly District, western pine beetle activity was still epidemic around the Ewauna sale area and at the higher elevations on the Owens, Deming Creek and Meryl Creek units. For the most part this loss occurred on private lands.

On the Dog Lake, Paisley, Warner and Silver Lake Districts losses for 1933 were practically down to normal. The Antelope, Oatman Flat, and McCarty Butte control projects on the Silver Lake District were very clean and although a few scattered groups could be found, there was no infestation aggressive enough to warrant control work.

The total loss of ponderosa pine timber due to insect activity in the Lakeview Circle during the past three years is estimated as follows:-

1931 ------	83,000,000	board feet
1932 ------	54,000,000	" "
1933 ------	13,500,000	" "

Malheur National Forest

Portions of the Malheur National Forest have suffered heavy losses of ponderosa pine timber from western pine beetle activity during the past three years. In the southwestern part of the forest in the Silvies Circle these losses total as much as 20 percent of the stand over large areas.

The extent of these losses and the trend of the recent epidemic is shown in the plot surveys conducted on the forest each year since 1931. The 1933 survey was made by Mr. Whiteside of the Bureau of Entomology with the help of Rangers Timms, Iler and Elliott during the period October 16-21.

The average loss on the four plots was 10 percent of the stand for the three year period 1931-33. The Saw Tooth Plot showed a loss of 24 percent while the Drumm Springs plot showed only a 3 percent loss.

The extremely low temperatures during the winter 1932-33 with a record low of 54 degrees below zero at Seneca, had their effect in destroying a high percentage of the overwintering broods. Bark counts made at the Murderer's Creek camp showed that an average of only 3 beetles emerged from a square foot of bark where in mild winters an emergence of 112 beetles to the square foot could be expected. This had the effect of reducing the infestation by 57 percent, but even so enough beetles were left to start recuperating their shattered forces, and there was a very noticeable increase in the 1933 overwintering broods over those of the 1933 summer.

Timber on the Hines Sale area has not been badly hit as yet, so the insect conditions on this forest will bear close watching to avoid such a catastrophe as has occurred on the nearby Snow Mt. Circle.

Mt. Hood National Forest

On the east side of this forest in the marginal ponderosa pine areas on both private and National Forest timber heavy beetle losses have been in progress since 1922. Due to the large number of small owners and the

low value of the timber, control measures have not been undertaken. Through large cordwood sales some of the National Forest infestation has been cleaned up. The 1933 beetle losses were probably less in volume than those of any recent previous year.

Ochoco National Forest

The period 1931-1933 was a disastrous one for the ponderosa pine stands of the Ochoco National Forest. Areas which had been practically free from pine beetle activity for many years suddenly developed outbreaks of unprecedented virulence. Over much of the private and national forest timberlands from 10 to 15 percent of the stand was killed and over a large part of the Snow Mountain unit of 200,000 acres 50 percent of the stand was destroyed in three years.

To combat these outbreaks, control operations were started on private and National Forest control units. The McKay Creek project was started in October, 1932 by the Forest Service and Klamath Forest Protective Association. Control operations covered 35,900 acres during the next three months. This work was so successful that only 7,680 acres of partly treated forest had to be included in the control program for 1933.

In spite of the benefit derived from the destruction of approximately 50 percent of the 1932 overwintering broods by cold weather, infestation was still so aggressive on a number of units in 1933 that control operations were started on the Mill Creek and Maury Mountain projects by the Forest Service and continued on the McKay Creek project by the private owners.

A large number of sample plots were established over the forest to check upon insect conditions and the effectiveness of control work. Two crews employed with NIRA funds and supervised by Mr. Jaenicke, Keen and Whiteside intensively cruised 9,280 acres of plots as a basis for estimates. Many of these plots can be used as permanent sample plots in future surveys. On the basis of this work and general observations, it is estimated that the following losses of ponderosa pine timber have been suffered on the Ochoco National Forest and adjacent private lands during the past three years:-

1931 ------	210,750,000	board feet
1932 ------	546,200,000	" "
1933 ------	135,300,000	" "

Rogue River National Forest

In the Applegate Ranger District, the western pine beetle has killed over one-half of the ponderosa pine stands since 1910 and has made brush fields out of many areas that once contained timber of fair quality. Because of the relatively low value of the timber, control measures have not been undertaken.

In the Butte Falls and Rogue River Ranger Districts, the western pine beetle has been very active along the lower edges of the ponderosa pine belt and on the dry ridge tops and poorer south slopes. In these losses, considerable private timber has been involved. The better stands of timber in these two ranger districts have not been seriously affected by this beetle work. Control work has not been undertaken because of the continued freedom of the better timber from beetle epidemics and because of the poor quality and mixed ownership of the infested stands.

In the Klamath Ranger District, what is known as the Seven Mile timber is being carefully watched. This is a decidedly overmature stand of ponderosa pine of excellent quality in which there have been a few slight flare-ups of beetle work. In 1933, the beetle losses were once again in an endemic status. Control work in this ranger district has been confined thus far to the infested lodgepole stands. Because of the proximity of the lodgepole infestations to the lodgepole forests of the Crater Lake National Park, the Forest Service has co-operated with the Park Service in this protection problem. The sun-curing method has been used to fight this mountain pine beetle infestation and the results have been very satisfactory. In 1934, the large lodgepole infestation in what is known as the Sun Pass area will be treated by the Forest Service. This will remove the last menace to park timber from infestations now in progress within the boundaries of the Rogue River National Forest.

Snoqualmie National Forest

A small portion of the Snoqualmie National Forest lies in the ponderosa pine belt east of the Cascades.

Insect losses do not appear to have been particularly heavy on this district in the past except that there evidently has been some increase in the last few years due to drought conditions. Now, following the cold weather of last winter, the general condition of the timber stand was found to be good with insect losses at a low ebb. One plot was cruised in the Tieton Ranger District during October by Mr. Beal assisted by W. H. Lund and Arnold Arneson of the Snoqualmie. In view of the moderate losses now being sustained, no control work was recommended.

Umatilla National Forest

The only serious insect situation on this forest within recent years was the western pine beetle epidemic in what is known as the Heppner Ranger District. The infestation covered almost 250,000 acres of ponderosa pine timber Ditch Creek and was divided fairly evenly between private and federal ownership. During the five year period 1929-1932 inclusive, the beetle loss amounted to about one hundred million board feet of ponderosa pine. This is equivalent to eight percent of the 1929 ponderosa pine stand. On account of the large privately owned areas adjacent to and intermingled with the national forest timber, it was not possible for the Forest Service to undertake control work. In December, 1932 and February, 1933, the unusually low temperatures killed over one

half of the beetle population on the area. During 1933, the infestation became fairly quiescent, probably as a result of the winter mortality.

Wallowa National Forest

The ponderosa pine stands on this forest are at present free of epidemic western pine beetle losses. The beetle damage in ponderosa pine has averaged about three-tenths of one percent annually for the past decade, the equivalent of what is known as normal or endemic beetle activity. Because of the over maturity of the ponderosa pine, the stands are likely to be more heavily attacked and should therefore be carefully watched for evidences of abnormal beetle work.

About 25 years ago the lodgepole stands on the Wallowa were killed on large areas by the mountain pine beetle. Since then, occasional beetle outbreaks have occurred but on a much smaller scale. Although the mountain pine beetle does attack ponderosa pine, it does not kill it in sufficient quantity to be a menace even when large lodgepole infestations are in progress near ponderosa pine stands.

Wenatchee National Forest

Two half section plots partly established on the Wenatche N. F. in 1931 were completed this year and recruised for current insect losses by Mr. Beal, with the assistance of G. C. Charlton, Edward Cliff and P. A. Brunsion of the Wenatchee.

As in other parts of the pine region, the western pine beetle was responsible for the greater part of the damage found, although this has not been particularly heavy in recent years. A flare up of losses in 1931 and 1932 was found to have subsided this year and no control work was advised. The beetle losses in the ponderosa pine of the Entiat Ranger District have been heavier than in other parts of the forest. If the need for control work should arise, the carrying out of such plans on national forest timber is complicated by the intermingled private ownership.

Whitman National Forest

Generally speaking, the only large pine beetle problem in the ponderosa pine timber on this forest has been in the Burnt River Ranger District. In the drainage of the south fork of Burnt River, the western pine beetle activity has been intermittently epidemic since 1920. In 1933, this infestation again became quiescent probably on account of the winter-killing of the larvae of the western pine beetle. An infestation on private and national forest ponderosa pine in the larger portions of Desolation Creek is in progress but it is largely confined to the marginal areas and to the drier sites. It shows little or no tendency to spread to the better stands of timber.

Many townships of ponderosa pine on this forest contain beetle infestations of only normal severity. This is a condition which is in decided contrast to the severe beetle epidemics in progress on large areas on the Ochoco and Malheur National Forests in the Blue Mountains.

INSECT CONDITIONS ON NATIONAL PARKS

Crater Lake and Mount Rainier National Parks are the only two in the region. Both of these were covered by insect surveys made by the Park Service and Bureau of Entomology.

Crater Lake National Park

An outbreak of the mountain pine beetle which started in 1925 and almost completely destroyed the lodgepole forests between Diamond Lake and Crater Lake was prevented from devastating the more valuable pine forests in the southern half of the park by continuous control efforts during the past eight years. The beetles in park timber were brought completely under control during 1933, with the final clean-up work carried on by two camps of CCC men. At present, the only virulent epidemic of this beetle near the park is centered on the Sun Pass area of the Rogue River National Forest. It is expected that this will be cleaned up during the coming year.

The dying of hundreds of Shasta red firs, and hemlocks during the past few years has caused considerable concern but it is not certain that insects are the primary cause of this damage.

Surveys were conducted during the year by Mr. Keen and Buckhorn of the Bureau of Entomology and by a crew employed by the Park Service.

Rainier National Park

Following the maintenance control work which has been in progress in this park for the past three years, the mountain pine beetle is now definitely under control in the important recreational areas of Longmire and White River. Only a small amount of yearly clean-up is needed to keep these beetles suppressed.

Examinations were made of these areas by Mr. Beal of the Bureau of Entomology and by the Park Rangers.

INSECT CONDITIONS ON INDIAN RESERVATIONS

Surveys of the five Indian Reservations in the region were made by Messrs. Keen and Beal of the Bureau of Entomology, by Mr. Harold Weaver appointed by the Indian Service under an ECW appointment in charge of insect control work, and by special insect control crews from ECW camps.

Colville-Spokane Indian Reservations

These two reservations were examined by Mr. Beal during the last two weeks in October and several sample plots established with the help of the forestry men and crews of CCC helpers. Later the reservations were examined by Mr. Weaver.

During the past five years, loss of ponderosa pine due to beetle attack has been very heavy but subsided in 1932, to a point where even the heavier infested areas only showed a loss of about 1.5 percent. The cold weather also had

its influence and the 1933 loss has dropped to an endemic situation. No control work was recommended.

Klamath Indian Reservation

Very comprehensive insect surveys have been conducted on this reservation during the past several years by crews under the supervision of Harold Weaver. The Bureau of Entomology also have four permanent sample plots on the reservation which are cruised annually. These surveys give a good basis for loss estimates.

The 1931 beetle loss was estimated by Weaver at 102,000 M. B. M. For 1932, the control areas and Bureau of Entomology plots showed a decline ranging from 9 to 70 percent. However, the general tendency was upward and the increased losses on untreated areas more than made up for the declines on other units. The total 1932 loss is estimated by Weaver at 136,00 M. B. M. Then with the cold winter of 1932-33 killing between 50 to 90 percent of hibernating broods, the 1933 loss took a big drop and is estimated at 54,000 M. B. M. or about 1.1 percent of the stand. Control work on some of the most heavily infested units is still advisable.

Yakima Indian Reservation

The ECW program on this reservation made it possible to organize an insect survey crew and cover the ponderosa pine areas with a very complete survey including both extensive and intensive plot work. This survey was supervised by Mr. J. L. Drake and later by Mr. O. J. Hauge employed under ECW appointments for this work. Examinations were also made by Keen and Weaver.

Following the 1931 windstorm, which blew over as much as 25 percent of the timber stand on some sections of the Cedar Valley unit, the beetles breeding in this material emerged and started an aggressive epidemic in the standing timber. Two sections checked by timber cruisers of Brown & Brown Co. showed additional losses of 20% and 28% of the stand due to beetle attack, and the Indian Service survey showed a loss in the Cedar Valley unit of 6.5 percent for 1932 and 3.1% in 1933. Throughout the forest these 1933 losses varied very considerably ranging from a low of .3 percent to 4.7 percent of the stand.

On the basis of the information secured in these surveys, control work was started with the CCC labor in the fall of the year and continued on the most heavily infested areas until weather conditions made further work impossible. It was renewed early this spring.

Warm Springs Indian Reservation

An inspection of the forests of the Warm Springs Reservation was made by Keen during the last days in August in company with the local forestry officials. During November, a more detailed survey of the reservation was made by Mr. Weaver and some plot work accomplished with the help of ECW labor.

For the last two years the loss of timber due to beetle attacks has been extremely heavy in the pine stands of this reservation, particularly on the poorer sites and in the fringe type. In terms of percent of stand killed, the recent losses varied from fully 50 percent on the Metolius bench to 15 percent on Mutton Mountain and about 3 percent of the pine timber on the reservation as a whole.

The 1933 losses have dropped to about .8 percent of the stand and are scarely more than normal in the better sites. Concentrated infestation is found on Mutton Mt., in the marginal sites, and from Old Mill to the northern boundary of the reservation. The heavy loss on the Metolius bench appears to be more the result of drought conditions than concentrated beetle attack.

Selective logging supplemented with control work has been recommended as a means of cleaning up the infestation on this forest, but sofar this work has barely gotten underway.

PRIVATE PROTECTION UNITS

Klamath Forest Protective Association

Timberlands in Klamath and Lake County under protection by the Klamath Forest Protective Association were covered by the Bureau of Entomology with the help of CCC labor. One crew operated in the Keno District under the supervision of Mr. Whiteside and two crews under Mr. Buckhorn's supervision rechecked the permanent sample plots in the Bly District.

Since 1917, the private timberlands of this protection unit have been hit by three successive barkbeetle outbreaks. The first period 1917-1923 brought heavy losses on all areas and called attention to the seriousness of the beetle problem. Approximately 8 percent of the pine timber stand in the entire unit was killed during this seven year period. The second epidemic followed immediately and lasted during the period 1924-1929 during six years an additional 9.7 percent of the stand was killed. Third wave of barkbeetle activity took place during the four year period 1930-33 during which the remaining timber stands suffered another loss of 7.6 percent.

These successive outbreaks of beetle depredations have so depleted the pine stands that many areas have been rendered unprofitable logging chances. The successive killing of the more beetle susceptible trees has opened up the stand to the thriftier more vigorous trees and has to a certain extent decreased the chances of further beetle damage on such a gigantic scale. This influence is already noticeable in that while 1932 was a peak year for losses over most of eastern Oregon, most plots in the Klamath country which had been heavily hit in previous years showed a decline. Then with the destruction of broods by the winter kill of 1932 and better growth conditions, a very marked drop in infestation was recorded for 1933, bringing the average loss down to .8 percent of the stand and many areas back to normal. However, some centers of beetle infestation, particularly in the higher and better sites, where previous beetle damage had been light, continued to support virulent beetle infestations.

THE CONTROL PROGRAM 1931, 1932, 1933

Western Pine Beetle Projects

Such work as was started in the fall of 1931, and spring of 1932 to control the western pine in ponderosa pine stands was directed towards generally increasing infestations, and for the most part was exceptionally successful. The statistics in respect to this work are given in Table No. 1.

Control work carried on in the fall of 1932 and spring of 1933 was supplemented by the winter killing of broods due to cold weather. The winter killing alone brought about reductions ranging from 23 to 75 percent and averaging about 50 percent. The combination of winter killing and control practically exterminated the beetles on control areas except where the original infestation was extremely heavy.

Results from the control work of the fall 1933-spring 1934 period will not be available until this fall.

Deschutes National Forest

The Fox Butte Project was covered for the third time in the fall of 1931 and 401 trees treated. This brought the area so completely under control that no further work was necessary in 1932 or 1933.

The Panhandle-Orphan Butte project was designed to halt the loss of reserve stand on cut over areas which were suffering from the effects of drought conditions and beetle attack. Some 2,287 trees were treated on 11,740 acres in the fall of 1931. These areas showed some improvement in 1932 with a reduction in losses of about 35 percent. No control work was done in the winter of 1932-33 on account of the destruction of broods by winter killing. However, a survey in 1933 showed that this had had little effect in reducing the loss of timber and that this loss was continuing at about the same rate. A recleaning of the area was made in the winter of 1933-34 and this should show to what extent insects are responsible for this loss and whether it can be halted by eliminating them.

Fremont National Forest

The Antelope Springs and McCarty Butte Projects were carried out in the fall of 1931 and 3,270 trees treated on 24,620 acres. An observational check was made in 1932 and 1933 which indicated that the work had been remarkably successful. While other areas of similar character were suffering unprecedented losses, these two areas and the intermediate Oatman Flat area were strikingly free from infestation. A check made in 1933 showed that the loss did not exceed .2 percent of the volume on the sample plot cruised.

Ochoco National Forest

The Alexander-Yawkey-McKay Creek Project was started in the fall of 1932 to try and stop the disastrous epidemic which was building up in the ponderosa pine stands of the Ochoco N. F. and adjacent private lands. Already a loss of from 10 to 15 percent of the stand had occurred and it was feared that large timbered tracts would be ruined unless these losses could be stopped.

In the fall of 1932, 35,900 acres were covered by the treating crews under the direction of the Forest Service and Klamath Forest Protective Association and 15,662 infested trees treated.

An analysis of the results of this work showed that while on untreated areas there was a natural reduction of about 48 percent, the treated areas showed an 85 percent reduction, which resulted in a total saving of 21,300 M. ft. of pine. Furthermore, the infestation was brought to such a low point that no follow up work was needed on 28,220 acres covered by the first thorough treatment. Recleaning of 7,680 acres and extension of the work onto 10,820 acres was carried out in the fall of 1933 by the Klamath Forest Protective Association.

The Mill Creek Project was an extension of the McKay Creek work and was carried out by the Forest Service with NIRA funds during the fall of 1933. Some 31,720 acres were covered and 4,850 trees treated, which served to extend the cleaned area over the entire Mill Creek basin.

The Maury Mountain Project was initiated and carried out by the Forest Service in the fall of 1933, with the treatment of 40,000 acres and disposal of 5,500 infested trees. This was also handled with NIRA funds. The work should give some interesting results as this entire body of isolated timber was covered with the control work.

Klamath Indian Reservation

Three heavily infested ponderosa pine units of the Klamath Indian Reservation were treated in the fall of 1931-spring 1932-the Antelope, Calimus and Long Prairie units-30,000 acres were covered and 8,023 trees treated. Unfortunately, the abandonment of the annual surveys which had been conducted in the past by the Indian Service prevented the usual check as to the results of this work. One 640 acre permanent Bureau of Entomology plot on the Antelope unit was included in the treatment. This showed a reduction in loss of from 394,840 board feet in 1931 to 119,360 board feet in 1932 or a reduction of 70 percent. This was secured in the face of generally increasing infestation in surrounding areas.

The Solomon Butte-Mt. Scott Project was carried out during the fall season of 1932, Control work covered 29,477 acres of cut over land and 4,730 acres of adjacent badly infested mature timber. A total of 4,375 trees were treated by the fell-peel-burn method at an approximate cost of $5.12 per tree. This work was done to stop heavy beetle losses in the thrifty reserve stand left on these areas following cutting. Trees of the younger age classes were killed without discrimination. The results of

of this work are not yet available but observations of the area in the fall of 1933 indicate that there had been a decided improvement and reduction of losses.

Klamath Forest Protective Association Projects

During the fall of 1931-spring 1932-control work was conducted on the Pokegama Unit of the Keno District and the Meryl Creek and Quartz Valley Units of the Bly District. A total of 15,080 acres were covered on these three units and 5,178 trees treated.

Check plots cruised by the Bureau of Entomology indicate the results of this work. On the Pokegama plot, the infestation was reduced from 207,915 board feet in 1931 to 99,565 board feet in 1932 for the 480 acres involved or a reduction of 52 percent. On the Meryl Creek plot a 514,280 board foot loss for 1931 was reduced to 476,090 board feet after treatment or a reduction of 7 percent. On a nearby untreated plot an infestation of 300,040 board feet in 1931 increased to 724,305 board feet in 1932 or an increase of 141 percent, so that the small reduction on the treated plot is not surprising in view of the very aggressive character of the infestation.

Mountain Pine Beetle Control Projects

Only two projects have been conducted recently to control mountain pine beetle outbreaks in this region.

Crater Lake National Park

Control work has been carried on almost continuously in this park since 1925 in an effort to prevent the complete destruction of the pine forests in the southern part of the park, while an outbreak too large to control was decimating the lodgepole stands in the forests surrounding the park. With the passing of this main epidemic to the south of the park the final clean-up within the park became possible.

In the spring of 1932, 30,070 acres were thoroughly combed for infestation by Park Service crews and 20,311 infested trees treated with the sun curing method.

In the spring of 1933, two CCC camps were available for control work and 30,750 acres were again covered and 7,026 infested trees treated but of this number only 5,794 were lodgepole pine which showed a great improvement over 1932 conditions. In the fall of 1933, a check survey showed that the mountain pine beetle had been practically exterminated in the park, but that the epidemic on the Sun Pass area of the Rogue River National Forest was still virulent. This is to be treated this spring.

Rainier National Park

Control work in the spring of 1931 covered very thoroughly the Longmire and White River areas of this park which are the two most important basins from the recreational standpoint, and disposed of all concentrated infesta-

tion of mountain pine beetle in white pine.

In 1932, these areas were given a recleaning and only 176 infested trees found. This further reduced the activities of the beetles and in the spring of 1933 only 50 infested trees could be located for treatment. A small amount of yearly maintenance work appears to be sufficient to keep these park areas free from beetle outbreaks.

Proposed Control Work 1933-1934

Forest Service

Under NIRA funds the following projects were approved for fall 1933-spring 1934 treatment:

Deschutes-Panhandle-Orphan Butte Project	--	Completed in January
Ochoco-Mill Creek Project	--	Completed in January
Maury Mt. Project	--	Completed in January
Rogue River-Sun Pass Project	--	To be covered in the spring program

Some work under the ECW program may be attempted during the season 1934-35 on the Malheur and Ochoco National Forests. How much of this will have to be covered cannot be definitely determined until the end of the coming summer.

National Park Service

Maintenance work will be conducted on both the Crater Lake and Rainier National Parks, in the spring of 1934, but since the beetles are under control in both parks, this will not be a very large or expensive program.

Indian Service

Under the ECW program, control of the western pine beetle will be continued during the spring of 1934 on the Yakima and Warm Springs Indian Reservations. It is understood that the Klamath also has funds for some work.

Private Timber Owners

The Klamath Forest Protective Association plans to complete the treatment of the Ochoco-Alexander-Yawkey tract during this winter, and also the treatment of "hot spots" in the Bly District of Klamath County. No decision as yet can be made in regard to the 1934-35 program.

ENTOMOLOGICAL INVESTIGATIONS

In addition to the help extended to forest protection agencies in the making of forest insect surveys and assisting with control projects, the Portland office of Forest Insect Investigations, Bureau of Entomology has been carrying forward a research program looking to a better understanding

of forest insect behavior and improvements in control technique. Some of the more important of these projects are briefly mentioned below.

Climatic Factors Affecting Barkbeetle Epidemics

This study has been underway during the past thirteen years through the annual plot survey of 25 640-acre plots in the pine region, in order to build up a background of basic data in respect to fluctuations in climatic factors, tree growth and barkbeetle activity. Only after a period of years can reliable conclusions be drawn as to the correlation of these various factors. Sofar the record shows three peaks of barkbeetle damage separated by short periods of quiescence. These changes exhibit a direct relationship to tree growth and an indirect relation to such climatic influences as the amount and seasonal distribution of precipitation. For instance, in the case of the western pine beetle, it is very evident that drought periods, affecting adversely the growth rate of the trees, are favorable for the building up of epidemics of this beetle. In connection with this study a tree ring "calendar" has been prepared showing the fluctuations in tree growth in the pine region during the past four hundred years.

Effect of Cold Weather Upon Barkbeetle Broods

Nature's control of barkbeetle epidemics through the medium of exceptionally cold winters was strikingly demonstrated during the winter of 1932-33 when from 50 to 90 percent of the western pine beetle broods were killed throughout northern California, Oregon and Washington by temperatures of 20 to 54 degrees below zero. Detailed studies were conducted throughout the region to determine what temperatures were effective in causing brood mortality; the lag between bark and air temperatures due to the insulating properties of the bark; and how thorough and lasting the effects of such natural control might be.

The lag between bark and air temperatures was determined by Beal and Buckhorn on the Ochoco N. F. by taking hourly temperature readings for a 66 hour period in February 1933 during which air temperatures dropped to 26° below zero.

The mortality which actually occurred in various parts of the region was determined by the analysis of hundreds of samples of infested bark sent in by the rangers from east side forests. These were carefully shaved up and the percent of mortality determined. This was found to vary from 25 to 92 percent depending upon the low temperature actually reached in the field. During the summer after emergence was complete, hundreds of square feet of bark from overwintering trees was examined. These samples showed that emergence following the freeze was from 55 to 95 percent below normal. The plot surveys further verified this information and showed that the 1933 infestation was only 25 to 50 percent that of 1932.

While it is obvious that cold winters are an important factor in halting barkbeetle outbreaks, it is also true that the effect may be only of temperary benefit. Late in 1933 it became apparent that in many areas the beetles were rapidly recovering from this set back and were again building up their numbers to epidemic proportions.

Western Pine Beetle Seasonal History Studies

In order to determine the normal seasonal development of Dendroctonus brevicomis and its associated parasites and predators in the pine region of central Oregon, a series of tree caging experiments have been conducted on the Ochoco National Forest during the past year. The information already obtained will be of assistance in directing control work so as to avoid destruction of beneficial insects without allowing the escape of the harmful barkbeetles.

Insect Damage to Fire Killed Douglas Fir

A co-operative study between the Forest Experiment Station, office of Forest Pathology and the Forest Insect Field Station has recently been started to obtain more comprehensive data upon the rate of deterioration of fire killed Douglas fir. A month or more of field work has already been given to the insect phase of this study and some very significant facts have been uncovered which may prove of considerable economic importance in connection with the salvage of killed timber on the Tillamook burn. For instance, it appears that Douglas fir heartwood remains sound almost indefinitely unless attacked by a large wood borer Ergates spiculatus. On one operation, where this borer had not been active trees killed in 1921 are now being logged with little additional loss over that caused by the original fire. On another operation, the work of this borer made operations unprofitable at the end of seven years. There is good reason to believe that this damage may be prevented by methods not involving unreasonable cost.

Preservation of Fire Killed Douglas Fir through Tree Medication

Experiments were recently started to determine the possibility of injecting wood preservatives into fire killed Douglas fir as a means of preventing insect attack and wood decay. Previous experiments by entomologists at the Asheville Station have shown that injections of mercuric chloride are very effective in preserving the wood of southern pines. It is possible that something of similar value may be found to retard the loss in fire killed Douglas fir.

Forest Insect Handbook - Region Six

Early in the year a handbook for forest officers covering the details of life history, habits and methods of controlling the more important forest insects was prepared jointly by the Forest Service and the Bureau of Entomology. Included in the handbook were detailed instructions for making barkbeetle surveys and conducting control projects. The handbook was distributed to all forest agencies in the region and should be consulted if detailed information concerning the forest insects and methods of control is desired.

SUMMARIZED BARKBEETLE DAMAGE ESTIMATES

In order to gain some idea as to the total damage caused by the western pine beetle throughout the ponderosa pine region of Oregon and Washington, broad general estimates have been made for the years 1931, 1932 and 1933 (Tables 7, 8, and 9). These estimates are based on (1) the various barkbeetle plot surveys (Tables 4, 5 and 6), (2) data taken on barkbeetle control projects (Tables 1, 2 and 3) and (3) general observations by members of the Forest Insect Station, field men of the Forest Service, Mr. Weaver of the Indian Service and others. The figures used for the pine stands are those recently compiled by Mr. Bruce Hoffman of the Office of Forest Management (USFS) modified in some cases to conform with more recent data for special areas.

These general estimates of western pine beetle damage indicate the following losses of ponderosa pine during the past three years:

	Volume of Ponderosa Pine Killed by Barkbeetles		
Year	Oregon	Washington	Total
	M. B. M.	M. B. M.	M. B. M.
1931	912,500	131,500	1.044,000
1932	1,438,000	269,000	1,707,000
1933	454,700	151,300	606,000
Total	2,805,200	551,800	3,357,00

This gross loss of over three billion feet represents about 4.35 percent of the total ponderosa pine in the two states, or a loss of 1.45 percent per year. The annual replacement by growth is normally about 1 percent of the stand volume per year, but during the past dry decade growth has been reduced to about .5 percent a year. As a result there has been a net loss of nearly 1 percent of the stand per year or a total of 2,195,000 M. B. M. not replaced by growth during the three year period 1931-1933 inclusive.

This loss compares with the saw timber cut as follows:-

		Ponderosa Pine Saw Timber Drain	
		Saw Timber Cut M.B.M.	Beetle Killed M.B.M.
1929	Oregon	1,119,389	563,000
	Wash.	449,420	57,000
	Total	1,568,809	620,000
1930	Oregon	959,581	602,000
	Wash.	335,054	58,000
		1,294,635	660,000
1931	Oregon	734,229	912,500
	Wash.	276,254	131,500
	Total	1,010,483	1,044,000
1932	Oregon	436,764	1,438,000
	Wash.	196,597	269,000
	Total	633,361	1,707,000

No recent estimates of the total forest losses due to other insects have been made. To secure a complete picture of the forest insect damage in the region the following should be included:

Damage to living trees through:

Destruction of lodgepole, white pine, etc. by mountain pine beetle.
Destruction of Douglas fir by the Douglas fir beetle.
Destruction of immature pine stands by the engraver beetles.
The slow killing of Sitka spruce by the spruce aphis.
Losses of hemlock timber by hemlock looper defoliation.
Losses in pine due to defoliations by the Pandora moth.
Destruction of white fir, red fir, hemlock, etc. by the fir engraver beetles.

Damage to felled trees, fire killed trees and forest products through:

Damage to fire killed Douglas fir by the Ergates woodborer.
Damage to logs by ambrosia beetles.
Damage to hardwood products by powder post beetles, Lyctus beetles, etc.

There are many other insects causing some damage to forests and forest products other than the few important ones mentioned above. Nor has any attempt been made to evaluate the amount of loss done by insects to shade trees and ornamentals.

ITEMS OF FOREST DRAIN IN THE PINE REGION

In the mature ponderosa pine forests of Oregon and Washington the most important items of drain upon the capital of pine stumpage are cutting, insects, fire, and windfalls.

During the five year period 1929-1933 inclusive, the lumber census figures show an average cut of 1,126,822 M. board feet of pine for the region. This amounts to about 1.47 percent of the mature pine stand.

Estimates of damage from forest fires are given in the State Forester's reports for State and private lands, but no comparable figures are available for National Forest, National Parks or Indian Reservations. Probably the most reliable estimates of this item of drain are those given in the recent Capper Report Revision which shows the volume of ponderosa pine killed by fire and not likely to be utilized based on the decade 1920-1929 to be as follows.

	Average annual loss from fire of Ponderosa Pine
Oregon	[illegible] M. B. M.
Washington	[illegible] M. B. M.
Total	112,917 M. B. M.

The loss from windfall is difficult to estimate. A certain amount of windfall goes on more or less steadily and then at periodic intervals major catastrophic storms occur which lay down an immense amount of timber over wide areas. One such storm occurred in the pine region in April 1931 and blew down timber from one end of the region to the other. Some local areas showed a loss averaging 25 percent of the stand. The estimate made for the Capper Report places the loss expectancy from wind at 200,000 M. board feet a year.

Roughly then the total of ponderosa pine drain from all causes during the past five years is as follows:

Average Annual Forest Drain	Percent of Stand	Ponderosa Pine M. B. M.
Cut	1.46	1,126,322
Beetle Kill	1.20	927,400
Windfall	.26	200,000
Fire	.15	112,417
	3.07	2,367,139

Against this drain there has been a growth replacement of about .5 percent a year in the mature virgin forests or a net drain of 2.57 percent a year. On the basis of these figures and provided the present rate of drain is maintained, the present mature pine in the region will last for about 40 years. However, the chances are that the average rate of drain for the past decade will not be maintained for a number of reasons. It is doubtful if

the lumber cut will be maintained in view of lumber codes and controlled production. Due to drought conditions the beetle kill of the last decade has been greatly above normal, and we have reason to believe that with a return to better conditions of tree growth this item of drain will be greatly reduced. Windfall and fire drain will probably remain about the same except that steady improvement in fire prevention and control and improvement in moisture conditions in the pine belt should reduce the fire losses even below the present moderate loss figure.

REFERENCE LIST OF MORE DETAILED REPORTS,

MEMORANDA AND PUBLICATIONS

National Forest Regional Reports

1932 "Progress Report of Barkbeetle Surveys Conducted on National Forests of Region Six Fall of 1931" - F. P. Keen--Mar. 15, 1932.

1932 "Comments and Recommendations on Proposed Forest Insect Control Projects in Region Six Fiscal Year 1933" - F. P. Keen March 15, 1932.

1933 "Supplementary Data on Insect Control Projects for 1922-1932 incl. in Region Six" - A. J. Jaenicke--Feb. 21, 1933.

1933 "Preliminary Insect Control Surveys and Studies, Progress Report for Period July 26-Aug. 31, 1933" - F. P. Keen Sept. 5, 1933.

Chelan National Forest

1933 "Memo of Barkbeetle Survey on Chelan National Forest Fall 1933" J. A. Beal--November 28, 1933.

Colville National Forest

1933 "Memo of Barkbeetle Survey on Colville National Forest Fall 1933" J. A. Beal--November 28, 1933.

Deschutes National Forest

General: "The Pine Beetle Situation in the South Portion of the Deschutes National Forest" - A. J. Jaenicke--Sept. 25, 1932.

1932 "Deschutes National Forest-1931 Barkbeetle Survey" -- F. P. Keen March 15, 1932.

1933 "Barkbeetle Survey on Deschutes National Forest Fall 1933" F. P. Keen--Dec. 4, 1933.

Metolius Area: "The Western Pine Beetle Situation in the Private and National Forest"Timber in and Adjoining the Sisters Working Circle, Deschutes National Forest" A. J. Jaenicke--March 1, 1932.

1932 "The Proposed Metolius Pine Beetle Control Project on the Deschutes National Forest" - A. J. Jaenicke--October 18, 1932.

Panhandle-Orphan Butte Projects:

1932 "The Proposed Orphan Butte Pine Beetle Control Project on the Deschutes National Forest, Oregon, March and April, 1932 - A. J. Jaenicke--March 1, 1932

1932 "The Proposed Recleaning of the Panhandle and Orphan Butte Areas and the Proposed Co-operative Insect Control Work with the Shevlem-Hixon Company" - H. J. Jaenicke--November 8, 1932.

1933 "Memo for Regional Forester-Panhandle-Orphan Butte Pine Beetle Control Project" - F. P. Keen--October 18, 1933.

1933 "Barkbeetle Survey on Deschutes National Forest Fall 1933" - F. P. Keen--December 4, 1933.

Fremont National Forest

1932 "The Proposed Silver Creek Insect Control Project on the Fremont National Forest" - A. J. Jaenicke--October 15, 1932.

1933 "Memo of Barkbeetle Survey on Fremont National Forest Fall 1933" F. P. Keen--November 28, 1933.

Malheur National Forest

1933 "Barkbeetle Survey on Malheur National Forest Fall 1933" - J. M. Whiteside--November 29, 1933.

Ochoco National Forest

General: "Memo. Proposed Pine Beetle Control Projects on Ochoco N. F. Season 1933-1934" - F. P. Keen--October 9, 1933.

1933 "Barkbeetle Surveys on the Ochoco N. F. Fall 1933" - F. P. Keen--December 5, 1933.

Maury Project: "The Pine Beetle Situation on the Maury Unit of the Ochoco National Forest" - A. J. Jaenicke--Oct. 6, 1932.

1933 "Progress Report of the Maury Insect Control Project" (Including November 28) - A. J. Jaenicke--Nov. 28, 1933.

McKay Creek Project: 1932 "The Pine Beetle Situation North of Prineville, Oregon" - A. J. Jaenicke--April 5, 1932.

1932 "The Western Pine Beetle Situation on Private and National Forest Timber North of Prineville, Oregon" - A. J. Jaenicke and Duncan McLean June 1, 1932.

1932 "The McKay Creek Insect Control Project. Progress Report #1 - A. J. Jaenicke--November 12, 1932.

1933 "Final Report on the October, 1932-January, 1933 Control Operations on the McKay Creek Brevicomis Project, Ochoco National Forest" - A. J. Jaenicke--Feb. 15, 1933.

1933 "Present Status of the McKay Creek Insect Control Project Area in the Vicinity of Prineville, Oregon as of Sept. 1933" A. J. Jaenicke and Duncan McLean--Sept. 19, 1933.

1933 "The Ochoco-McKay Creek Pine Beetle Control Project Analysis of Results and Recommendations for Additional Control Work During Fall of 1933." - F. P. Keen--October 9, 1933.

1933 "Progress Report No. 2, on the McKay Creek Insect Control Project as Conducted by the Klamath Forest Protective Association." A. J. Jaenicke--November 30, 1933.

Mill Creek Project

1933 "Memo. on the Present Status of the Mill Creek Infestation" A. J. Jaenicke--October 5, 1933.

1933 "Progress Report on Mill Creek Insect Control Project as of November 27, 1933" - A. J. Jaenicke--November 28, 1933.

Ochoco Creek Area

1932 "The Status of the Ochoco Creek Western Pine Beetle Infestation in May, 1932" - A. J. Jaenicke--June 8, 1932.

1932 "Report of the Pine Beetle Situation on the Lands of the Ochoco N. F." - F. P. Keen--October 4, 1932.

Rogue River National Forest (Crater N. F.)

1932 "Proposed Forest Service Co-operation with U. S. Park Service for Control of Lodgepole Infestations in the Crater Lake National Park and Crater National Forest Spring of 1932" A. J. Jaenicke--Feb. 25, 1932.

Snoqualmie National Forest

1933 "Barkbeetle Survey on Snoqualmie National Forest Fall 1933" J. A. Beal--November 28, 1933.

Wenatchee National Forest

1933 "Barkbeetle Survey on Wenatchee National Forest Fall 1933" - J. A. Beal--November 28, 1933.

National Park Reports

Crater Lake National Park

1932 "The Mountain Pine Beetle Situation in Crater Lake National Park and Surrounding National Forest Areas Season 1931 and Recommendations for Control Spring 1932" - F. P. Keen--January 25, 1932.

1932 "Preliminary Memo. on Crater Lake N. P. Insect Control Need for Spring 1932" - F. P. Keen--January 15, 1932.

1932 "Report on the Insect Control Project Spring 1932" - Frank J. Solinsky III---October, 1932.

1932 "The Mountain Pine Beetle Situation Crater Lake National Park and Adjacent National Forest Lands-Season 1932-Maintenance Control Program For Spring 1933" - F. P. Keen, November 15, 1932.

1933 "Report on the Insect Control Project Spring 1933, Crater Lake National Park" - Frank J. Solinsky III--August 1, 1933.

1933 "Report of the Mountain Pine Beetle Situation in Crater Lake National Park and Adjacent Lands of the Rogue River National Forest Season 1933-Maintenance Control Program for Spring 1934. F. P. Keen---November 20, 1933.

Mount Rainier National Park

1932 "Report of Mountain Pine Beetle Situation in Rainier National Park Fall 1931" - J. A. Beal--January, 1932.

Indian Reservations

Colville-Spokane Indian Reservations

1933 "Report of an Examination of the Barkbeetle Infestation on the Colville and Spokane Indian Reservations Fall 1933" J. A. Beal---November, 1933.

Klamath Indian Reservation

1932 "Report of Pine Beetle Control Operations Klamath Indian Reservation Oregon, Calendar Year, 1931" - Harold Weaver--March 21, 1932.

1933 "Winter Killing Western Pine Beetle, Klamath Indian Reservation 1932-1933 and The Solomon-Butte-Mt. Scott Pine Beetle Control Project KIR-Fall of 1932" - Harold Weaver

1933 "Report of Pine Beetle Survey, Klamath Indian Reservation Summer of 1932" - Harold Weaver---March, 1933.

Yakima Indian Reservations

1933 "Report of an Examination of the Pine Beetle Infestation in the Forests of The Yakima Indian Reservations and Recommendations for Control Under the ECW Program-1933-1934" F. P. Keen--August 21, 1933.

1933 "Report on Dendroctonus brevicomis Infestation Yakima Indian Reservation" - J. D. L. Drake--September 30, 1933.

1933 "Recommendations for Pine Beetle Control on the Yakima Indian Reservation, Washington 1933-1934 ECW Programme" - Harold Weaver

Warm Springs Indian Reservation

1933 "Memo.-The Pine Beetle Situation in the Forests of the Reservation (Warm Springs)" - F. P. Keen--September 5, 1933.

1934 "Memo.-The Pine Beetle Situation on the Warm Springs Indian Reservation" - Harold Weaver--Jan. 9, 1934.

Private Land Areas

1932 "Memo-Inspection of Dying Trees in the Vicinity of Salem, Oregon, (McNary Farm)" - F. P. Keen and H. G. Lachmund--Aug. 29, 1932.

Alexander-Yawkey Prineville Project

1932 "Report of Pine Beetle Situation on Lands of Alexander-Yawkey Timber Co. and Other Properties in and Adjacent to Ochoco National Forest" - F. P. Keen--October 1, 1932.

1933 "Report of Pine Beetle Control Operation-Prineville Project Fall and Winter 1932-1933--Duncan McLean.

Southern Oregon Areas

1933 "Report of Southern Oregon Pine Beetle Surveys During Season 1931-1932. Statistical Report No. 9. - F. P. Keen--July, 1933.

1933 "Report of Pine Beetle Surveys and Studies on Protection Units of Klamath Forest Protective Association-Season of 1933" F. P. Keen--November 25, 1933.

Areas in Klickitat County-Washington

1932 "Report of Examination of Timber Holdings of Vernon Parish Lumber Co. on Yakima Indian Reservation, Washington." F. P. Keen--August 30, 1932.

1932 "Memo of Examination of the Holdings of the J. Neil Lumber Co. in Klickitat County, Wash." - F. P. Keen--October 31, 1932.

1932 "Report of Examination of Pine Beetle Damage on Holdings of The Eastern and Western Lbr. Co. Nov. 1-3, 1932" - F. P. Keen November 9, 1932.

Recent Forest Insect Research Reports

General

"Annual Report for 1932 and Program for Fiscal Year 1934 of Forest Insect Field Station, Portland, Oregon" - F. P. Keen--April 3, 1933.

Temperature Studies

"Relation of Air and Bark Temperatures of Infested Ponderosa Pines During Sub-Zero Weather" - J. A. Beal--February 24, 1933.

"Mortality of Mountain Pine Beetle Following Sub-Zero Weather." F. P. Keen--March 15, 1933.

"Low Temperatures as a Limiting Factor in Western Pine Beetle Epidemics. Progress Report No. 1" - F. P. Keen and J. A. Beal--April 20, 1933.

Hemlock Looper

"Further Studies on the Hemlock Looper in Southwestern Washington" J. A. Beal--May 15, 1933.

FOREST INSECT PUBLICATION

Beal, A. J.

"Temperature Extremes as a Factor in the Ecology of the Southern Pine Beetle."--Journal For. Vol. XXI, p. 329--March, 1933.

Keen, F. P.

"An 8-Year Campaign Against the Mountain Pine Beetle."--Forest Worker--January, 1933.

"A Note on the Hibernating Habits of Sane Engraver Beetles of the Genus Ips."--Jour. Econ. Ent. Vol. 26, No. 1, p. 297. February, 1933.

"Thick Bark Protects Pine Beetles from Fatal Sub-Zero Temperatures" Forest Worker--July, 1933.

Weaver, Harold

"The Development and Control of Pine Beetle Epidemics."--Jour. For. Vol. XXXII, No. 1, p. 100--January, 1934.

APPENDIX

CONTROL WORK CONDUCTED DURING PERIOD

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TABLE NO. 1

CONTROL WORK CONDUCTED DURING PERIOD

FALL 1931 - SPRING 1932

WESTERN PINE BEETLE CONTROL IN PONDEROSA PINE

Area-Unit or Project	Trees Treated	Volume Treated M.B.M.	Acres Covered	Cost	Work Done By
Deschutes N. F.					
Fox Butte Project	401	-	3,600	$1,271.90	Forest Service
Panhandle-Orphan Butte	2,287	-	11,740	4,893.00	" "
Fremont N. F.					
Antelope Springs	1,914	1,914	10,560	$7,349.76	Forest Service
McCarty Butte	1,356	1,356	14,060	3,973.08	" "
Klamath Indian Res.					
Antelope Unit	1,649	1,832,000	5,120	$5,716.97	Algoma Lbr. Co.
Calimus Butte	703	662,000	6,700	4,134.34	Indian Service
Long Prairie	5,671	1,652,000	18,560	16,311.98	" "
Klamath County, Ore.					
Keno District	2,017	3,777	8,160	$3,665.29	K. F. P. A.
Bly District	3,161	4,195	6,920	7,640.90	K. F. P. A.
	MOUNTAIN PINE BEETLE CONTROL IN LODGEPOLE AND WHITE PINE				
Crater Lake N. P.	20,311	-	30,070	$17,357.70	Park Service
Rainier N. P.	176	6 "* gr tree	3,000	880.00	" "

TABLE NO. 2

CONTROL WORK CONDUCTED DURING PERIOD

FALL 1931 - SPRING 1932

WESTERN PINE BEETLE CONTROL IN PONDEROSA PINE

Area-Unit or Project	Trees Treated	Volume Treated	Acres Covered	Cost	Work Done By
Ochoco N. F.					
McKay Creek (F. S.)	4,146	3,500	17,960	$10,245.00	Forest Service
" " (Private)	11,516	9,800	17,940	20,430.46	Klamath F.P. Ass'n
Total	15,662	13,300	35,900	$30,675.46	
Klamath Indian Res.					
Solomon Butte	4,375	2,020	34,207	13,602.30	Indian Service

MOUNTAIN PINE BEETLE CONTROL

IN LODGEPOLE AND WHITE PINE

Crater Lake N. P.	7,026 @ 1.00 p. tree	30,750	7,026 E. C. F.	C. C. C.
Rainier N. P.	50 @ 5.00 p. tree	3,000	250	-

TABLE NO. 3

CONTROL WORK CONDUCTED
DURING FALL OF 1933
IN
WESTERN PINE BEETLE INFESTATIONS

Area, Unit or Project	Trees Treated	Volume Treated, M.B.M.	Acres Covered	Cost	Work Done By
Deschutes N. F.					
Panhandle-Orphan Butte	3,002	2,500	17,500	$ 7,249	Forest Service
Ochoco N. F.					
McKay Creek*	4,400	-	18,500	8,360	Klamath F.P. Ass'n.
Mill Creek	4,883	4,150	35,000	14,700	Forest Service
Maury Mountain	7,895	5,921	58,600	27,843	Forest Service
Yakima Indian Reservation	303	-	-	-	Indian Service

*Work done by gypo contracts. Forest Service work done under Nira wage scale.

TABLE NO. 4

SUMMARY OF ACTUAL CRUISING DATA

PONDEROSA PINE LOSSES FOR 1931

OREGON

Protection Unit and Area	Acres Cruised	Volume of Pine on Plots	Volume Killed in 1931	Percent of Stand Killed
Klamath Forest P. A.		M. B. M.	Board Ft.	
Keno District (1)	4,640	54,757	1,778,320	3.25%
Bonanza Dist. (1)	5,120	45,495	1,561,000	3.44
Bly District (1)	6,400	97,711	2,828,090	2.89
Klamath Indian Res. (3)	22,880	200,000	4,590,600	2.29
Deschutes N. F.				
LaPine Dist. (2)	320	4,461	25,940	.56
Pot Holes Dist. (2)	320	2,444	67,880	2.78
" " " (4)	11,700	110,631	3,060,000	2.77
Metolius (2)	1,920	33,700	345,000	1.02
Malheur N. F. (2)	640	9,059	219,800	2.43
Total For Oregon	53,940	558,258	14,476,630	2.59

WASHINGTON

Klickitat County				
Eastern & Western Co.(5)	320	3,520	109,700	3.11
Vernon Parish (5)	720	5,760	280,000	4.86
Chelan N. F. (2)	640	4,800	105,760	2.20
Colville N. F. (2)	320	2,720	57,420	2.11
Total For Washington	2,000	16,800	552,880	3.29
Total For Region	55,940	575,058	15,029,510	2.61

(1) Bureau of Entomology Surveys
(2) Co-operative B. E. & U.S.F.S. Surveys
(3) Indian Service Surveys-Weaver
(4) Forest Service Survey-Fred Matz
(5) Co-operative B.E. & Private Owner Surveys

TABLE NO. 5

SUMMARY OF ACTUAL CRUISING DATA

PONDEROSA PINE LOSSES FOR 1932

Protection Unit and Area	Acres Cruised	Volume of Pine on Plots	Volume Killed in 1932	Percent of Stand Killed
		M.B.M.	Board Ft.	
Klamath Forest P. A.				
Keno District	4,170	54,379	1,321,800	2.4
Bonanza District	4,670	45,150	1,352,330	3.0
Bly District	4,280	65,799	3,154,695	4.8
Fremont National Forest	960	10,540	103,990	1.0
Deschutes N. F.				
LaPine	320	4,631	12,110	.3
Pot Holes	320	2,444	109,130	4.5
Metolius	1,600	28,040	322,625	1.2
Panhandle-Orphan-Butte	1,760	8,800	268,000	3.0
Ochoco N. F.	2,880			
McKay Creek	2,880	28,800	2,272,710	7.9
Mill Creek	1,760	19,305	736,800	3.8
Marks-Ochoco Crk.	1,680	35,000	1,261,543	3.6
Maury	640	7,000	538,650	7.7
Sunflower Flat.	640	5,000	183,350	3.7
Snow Mt.	2,000	25,000	3,500,000	14.0
Malheur N. F.	640	5,712	288,110	5.1
Total For Oregon	28,320	345,600	15,425,843	4.47

WASHINGTON

Yakima Indian Res.	2,860	37,826	1,010,760	2.7
Snoqualmie N. F.	320	3,840	35,060	.9
Wenatchee N. F.	640	3,800	142,460	3.8
Chelan N. F.	640	3,840	62,420	1.6
Colville N. F.	320	2,384	70,650	3.0
Colville-Spokane-Ind. Res.	1,280	11,220	110,880	1.0
Total For Washington	6,060	62,910	1,432,230	2.28
Total For Region	34,380	408,510	16,858,073	4.13

TABLE NO. 6

SUMMARY OF ACTUAL CRUISING DATA

PONDEROSA PINE LOSSES FOR 1933

OREGON

Protection Unit and Area	Acres Cruised	Volume of Pine on Plots	Volume Killed in 1933*	Percent of Stand Killed
		M.B.M.	Board Feet	
Klamath Forest P. A.				
Keno District	4,170	54,379	667,000	1.2
Bonanza District	4,670	45,150	549,000	1.2
Bly District	4,280	65,799	783,500	1.2
Fremont N. F.	960	10,540	38,800	.4
Deschutes N. F.				
LaPine	320	4,631	13,000	.3
Pot Holes	320	2,444	44,200	1.7
Metolius	1,600	28,040	249,400	.9
Panhandle-Orphan Butte	1,760	8,800	212,000	2.4
Ochoco N. F.				
McKay Creek	2,880	28,800	515,350	1.8
Mill Creek	1,760	19,305	439,250	2.3
Mark-Ochoco Creek	1,680	35,000	501,900	1.4
Maury	640	7,000	202,600	2.9
Sunflower Flat	640	5,000	44,100	.9
Snow Mt.	2,000	25,000	535,000	2.1
Malheur N. F.	640	5,712	123,700	2.2
Total For Oregon	28,320	345,600	4,918,800	1.42

*Partly Estimated

WASHINGTON

Yakima Ind. Res.	2,860	37,826	1,112,790	2.9
Snoqualmie N. F.	320	3,840	46,090	1.2
Wenatchee N. F.	640	3,800	74,780	2.0
Chelan N. F.	640	3,840	40,380	1.0
Colville N. F.	320	2,384	19,530	.8
Colville-Spokane Ind. R.	1,280	11,220	57,100	.5
Total For Washington	6,060	62,910	1,350 ,670	2.15
Total For Region	34,380	408,510	6,269 ,470	1.53

TABLE NO. 7

ESTIMATED PONDEROSA PINE LOSSES

FOR 1931

OREGON

Circle Area	Oregon Timber Resources		Percent Stand Killed	Volume Killed 1931 M.B.M.
	Acreage	Volume Pine Million Bd. Ft.		
Klamath Circle	M. Acres			
Keno District	305	2,900	1.5	44,000
Bonanza District	170	680	2.3	15,600
Bly District	240	2,000	2.9	58,000
Klamath Ind. Res.	800	5,250	2.0	102,000
Yawkey Tract	15	270	1.0	2,700
Long-Bell Tract	87	1,400	1.5	21,000
Silver Lake Area	43	750	3.0	22,500
Other Areas	1,200	5,670	.5	28,200
Klamath Circle-Total	2,860	18,920	1.55	294,000
Lakeview Circle				
Dog Lake	160	1,100	1.5	16,500
Warner Mt.	170	950	1.0	9,500
Thomas Creek	130	820	2.0	16,500
Chewaucan	180	1,620	2.5	40,500
Lakeview Circle-Total	640	4,490	1.85	83,000
Bend Unit				
Paulina Circle	235	1,520	.9	13,000
Panhandle-Orphan Butte	12	60	4.7	2,800
Bend Circle	806	6,100	1.2	73,200
Sisters Circle	407	3,960	1.0	39,600
Metolius Area	36	420	1.0	4,200
Warm Springs Ind. R.	350	1,720	1.0	17,200
The Dalles	284	1,150	1.5	17,300
Ochoco Circle				
McKay Creek	56	600	2.5	15,000
Mill Creek	37	330	1.5	5,000
Marks-Ochoco Cr.	85	1,050	3.5	36,800
Maury	40	320	1.5	4,800
Wolf Mt.	220	1,760	2.0	35,200
Waterman	50	250	1.5	3,700
Other	288	1,900	.7	13,300
Total Ochoco Circle	776	6,210	1.83	113,800

TABLE NO. 7-CONT.
1931 Oregon Losses (Cont.)

Circle Area	Timber Resources: Acreage M. Acres	Timber Resources: Volume Million Bd.Ft	Percent Stand	Volume Killed 1931 M.B.M.
Malheur-Burns Unit				
Snow Mt. Circle	328	2,430	4.0	97,000
Silvies Circle	592	4,890	1.25	61,000
N. F. K. Malheur Circle	190	1,700	1.0	17,000
Total Malheur-Burns	1,110	9,020	1.94	175,000
LaGrande Circle	3,242	4,480	.7	31,300
Fossil Circle	254	1,380	1.0	13,800
Baker Circle	1,188	4,890	.7	34,300
Total For Oregon	12,200	64,320	1.42	912,500

ESTIMATED PONDEROSA PINE LOSSES

FOR 1931

WASHINGTON

Klickitat Circle				
Glenwood	135	1,060	.7	7,400
Goldendale	75	630	3.5	22,100
Cedar Valley	157	890	3.6	32,000
Satus Block	120	240	.5	1,200
Upper Klickitat	90	810	1.0	8,100
Toppenish Creek	103	510	.5	2,500
Total Klickitat Circle	680	4,150	1.76	73,300
Yakima Circle	340	2,050	.5	10,200
Wenatchee Circle	180	1,060	1.2	12,700
Okanogan Circle	400	2,330	.7	16,300
Spokane-E. Colville	200	3,170	.6	19,000
Total For Washington	2,800	12,760	1.03	131,500
Total For Region	15,000	77,080	1.36	1,044,000

TABLE NO. 8

ESTIMATED PONDEROSA PINE LOSSES

FOR 1932

OREGON

Circle Area	Timber Resources: Acreage Thousand Acres	Volume Pine MBM	Percent Stand Killed	Volume Killed 1932
Klamath Circle				
Keno District	305	2,850	1.1%	31,000
Bonanza District	170	660	2.7	17,900
Bly District	240	1,880	4.2	79,700
Klamath Ind. Res.	800	5,140	2.6	136,000
Yawkey Tract.	15	270	1.5	4,000
Long Bell Tract.	87	1,400	1.8	25,200
Silver Lake Area	43	750	1.4	10,500
Other Areas	1,200	5,670	1.0	56,700
Total (K. C.)	2,860	18,620	1.94	361,000
Lakeview C.-Total	640	4,490	1.20	54,000
Bend Unit				
Paulina Circle	235	1,520	1.5	23,000
Panhandle-Orphan Butte	12	60	3.0	2,000
Bend Circle	806	6,100	1.6	98,000
Sisters Circle	407	4,000	1.2	48,000
Metolius Area	36	420	1.2	5,000
Warm Springs	350	1,710	1.4	24,000
The Dalles	284	1,150	2.0	23,000
Ochoco Circle				
McKay	56	590	7.5	44,000
Mill Creek	37	330	3.5	11,500
Marks-Ochoco	85	1,020	7.0	72,000
Maury	40	320	7.8	25,000
Wolf Mt.	220	1,750	3.2	56,000
Waterman	50	250	6.0	15,000
Other	288	1,890	1.2	22,500
Total (O. C.)	776	6,150	4.0	246,000
Malheur-Burns Unit				
Snow Mt. Circle	328	2,420	12.4	300,000
Silvies Circle	592	4,880	2.0	97,500
N. F. K. Malheur C:	190	1,700	1.7	28,700
Total (M. B.)	1,110	9,000	4.74	426,200
LaGrande Circle	3,242	4,470	1.0	44,700
Fossil Circle	254	1,370	2.5	34,200
Baker Circle	1,138	4,890	1.0	48,900
TOTAL FOR OREGON	12,200	63,950	2.25	1,438,000

TABLE NO. 8-CONT.

ESTIMATED PONDEROSA PINE LOSSES

FOR 1932

WASHINGTON

Circle Area	Timber Resources: Acreage Thousand A:	Volume Pine M. B. M.	Percent Stand Killed	Volume Killed 1932
Klickitat Circle				
Glenwood	135	1,060	3.0	31,800
Eastern & Western	75	610	6.5	40,000
Cedar Valley	157	860	6.5	54,000
Satus Block	120	240	1.0	2,400
Upper Klickitat	90	800	2.0	16,000
Toppenish Creek	103	510	1.0	5,100
Total-Klickitat Co.	680	4,080	3.7	149,300
Yakima Circle	340	2,050	1.0	20,500
Wenatchee Circle	180	1,050	2.5	26,200
Okanogan Circle	400	2,330	1.5	35,000
Spokane-E. Colville	200	3,170	1.2	38,000
TOTAL FOR WASHINGTON	2,800	12,680	2.12	269,000
TOTAL FOR REGION	15,000	76,630	2.17	1,707,000

TABLE NO. 9

ESTIMATED PONDEROSA PINE LOSSES

FOR 1933

OREGON

Circle Area	Timber Resources: Acreage	Timber Resources: Volume Pine	Percent Stand Killed	Volume Killed 1933
Klamath Circle	Thousand A.	Million Bd.Ft.		M.B.M.
Keno District	305	2,820	.6	17,000
Bonanza District	170	640	1.1	7,000
Bly Dist.	240	1,800	1.1	20,000
Klamath Ind. Res.	800	5,000	1.1	54,000
Yawkey Tract	15	270	.2	500
Long Bell Tract.	87	1,400	.7	9,800
Silver Lake Area	43	750	.3	2,200
Other Areas	1,200	5,670	.2	11,300
Total (K. C.)	2,860	18,350	.66	121,800
Lakeview C.-Total	640	4,490	.30	13,500
Bend Unit				
Paulina Circle	230	1,490	.6	9,000
Panhandle-Orphan Butte	17	90	2.8	2,500
Bend Circle	806	6,100	.6	36,500
Sisters Circle	407	3,960	.9	34,200
Metolius Area	36	420	.9	3,800
Warm Springs	350	1,700	.8	14,000
The Dalles	284	1,120	.7	7,800
Ochoco Circle				
McKay	56	570	1.7	9,700
Mill Creek	37	320	2.1	6,800
Marks-Ochoco	85	960	1.9	18,000
Maury	40	320	3.1	9,800
Wolf Mt.	220	1,710	.8	13,700
Waterman	50	240	2.4	5,700
Other	288	1,890	.3	5,600
Total (O. C.)	776	6,010	1.15	69,300
Malheur-Burns				
Snow Mt. Circle	328	2,100	3.1	66,000
Silvies Circle	592	4,830	.6	29,000
N. F. K.-Malheur	190	1,690	.5	8,400
Malheur-Burns-Total	1,110	8,620	1.2	103,400
LaGrande Circle	3,242	4,470	.3	13,400
Fossil Circle	254	1,350	.8	10,800
Baker Circle	1,188	4,890	.3	14,700
TOTAL FOR OREGON	12,200	63,060	.72	454,700

TABLE NO. 9 - Cont.

ESTIMATED PONDEROSA PINE LOSSES

FOR 1933

WASHINGTON

Circle Area	Timber Resources: Acreage Thousand A	Timber Resources: Volume Pine Million Bd. Ft	Percent Stand Killed	Volume Killed 1933
Klickitat Circle				
Glenwood	135	1,040	1.0	10,400
Eastern & Western	75	580	2.1	12,200
Cedar Valley	157	820	3.8	31,500
Satus Block	120	240	.3	700
Upper Klickitat	90	790	2.3	18,200
Toppenish Creek	103	500	.3	1,500
Total Klickitat C.	680	3,970	1.88	74,500
Yakima Circle	340	2,040	1.2	24,500
Wenatchee Circle	180	1,030	1.0	10,300
Okanogan Circle	400	2,300	1.0	23,000
Spokane-E. Colville	1,200	3,160	.6	19,000
TOTAL FOR WASHINGTON	2,800	12,500	1.21	151,300
TOTAL FOR REGION	15,000	75,560	.80	606,000